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BIBLIOGRAPHY OF RECENT LITERATURE ON FLOTATION OF ORES

JULY TO DECEMBER, 1916

COMPILED BY

D. A. LYON, O. C. RALSTON, F. B. LANEY, AND R. S. LEWIS

WASHINGTON
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BIBLIOGRAPHY OF RECENT LITERATURE ON FLOTATION OF ORES.

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INTRODUCTION.

This bibliography is a continuation of that given in Technical Paper 135 of the Bureau of Mines, which covered the first half of 1916. The present paper includes references to articles that appeared from July 1 to December 31, 1916, in the following periodicals:

Bulletin of the American Institute of Mining Engineers.
Canadian Mining Institute bulletins.
Chemical Engineer and Manufacturer.
Engineering and Mining Journal.
Metallurgical and Chemical Engineering.
Mexican Mining Journal.
Mining American.
Mining and Engineering World.
Mining and Scientific Press.
Patent Office Gazette.
Proceedings of the American Institute of Mining Engineers.
Salt Lake Mining Review.
Transactions of the Chemical, Metallurgical, and Mining Society of South Africa.

BIBLIOGRAPHY.

ADAM, H. R. Ore treatment at the Falcon mine (Rhodesia). Trans. Chem. Met. and Min. Soc. South Africa, vol. 17, November, 1916, pp. 91–96. Describes mill and smelter of the Falcon mine at Umvuma, 160 miles from Bulawayo. The mill handles 15,000 tons of sulphide ore monthly. The vanner tailings are reground for flotation in a 9-cell Minerals Separation machine, the feed to which averages 1.8 per cent copper and 2.3 pennyweight gold per ton. The monthly recovery is 2,000 tons of concentrate, averaging 8 to 9 per cent copper and 5 pennyweight gold per ton, the recovery being 86 per cent of the copper and 43 per cent of the gold. The total extraction in the mill is 80 per cent of the gold and 90 per cent of the copper. This is the first large-scale flotation plant at work in South Africa.

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ADAMS, MAXWELL. A new flotation oil from sage brush. Min. and Eng. World, vol. 45, Sept. 16, 1916, p. 490. Lists some physical properties and gives method of extraction.

AMERICAN INSTITUTE OF MINING ENGINEERS. An explanation of the flotation process. Bulletin 120, December, 1916, pp. 2232–2233. Discussion, by O. C. Ralston, of the paper presented at the Arizona meeting, September, 1916, and printed in the bulletin for August, 1916.

——— Flotation concentration at Anaconda, Mont. Bulletin 119, November, 1916, pp. 1889–1896. Discussion by Norman Carmichael, David Cole, W. B. Cramer, Rudolf Gahl, B. B. Gottsberger, R. S. Handy, E. P. Mathewson, C. W. Merrill, C. E. Mills, O. C. Ralston, F. S. Schimerka, and A. P. Watt of paper by Frederick Laist and A. E. Wiggin, presented at the Arizona meeting, September, 1916, and printed in Bulletin 111, March, 1916, pp. 549–581.

——— The flotation of minerals. Bulletin 120, December, 1916, pp. 2234–2235. Discussion by O. C. Ralston of paper by R. J. Anderson presented at the Arizona meeting, September, 1916, and printed in Bulletin 115, July, 1916, p. 1119.

——— History of the flotation process at Inspiration. Bulletin 119, November, 1916, pp. 1879–1888. Discussion by R. C. Canby, David Cole, F. G. Cottrell, Rudolf Gahl, R. S. Handy, Frederick Laist, E. P. Mathewson, C. E. Mills, H. W. Morse, L. D. Ricketts, G. H. Ruggles, and F. S. Schimerka of paper by Rudolf Gahl presented at the Arizona meeting, September, 1916, and printed in Bulletin 117, September, 1916, pp. 1627–1681.

——— A new flotation oil and a new source of flotative agents. Bulletin 119, November, 1916, pp. 1897–1899. Discussion by O. C. Ralston of paper by Maxwell Adams and G. H. Clevenger presented at the Arizona meeting, September, 1916, and printed in Bulletin 117, September, 1916, pp. 1683–1692.

ANDERSON, R. J. The flotation of minerals. Am. Inst. Min. Eng., Bull. 115, July, 1916, p. 1119. Reviews briefly the following subjects: Surface and interfacial tension; absorption; occlusion; colloids; emulsion; electrolytic and electrostatic phenomena; froth and bubbles; oils, air, and gas. A selective bibliography is given.

——— The metallurgical disposal of flotation concentrates. Mexican Min. Jour., vol. 21, June, 1916, p. 212. Discusses methods of breaking flotation froth, of dewatering and drying, and of smelting or preparation for smelting, such as sintering, nodulizing, and roasting.

ANDROS, S. O. Early flotation practice by the Jemez Indians. Eng. and Min. Jour., vol. 102, Dec. 23, 1916, p. 1106. Crushed sandstone containing malachite was boiled in fine pitch. The floated malachite was used as a green paint for ceremonial boards used in certain dances.

BELCHIC, GEORGE, AND NEAL, ROY O. Surface tension of oil-water emulsions—a flotation theory. Min. and Eng. World, vol. 45, Sept. 16, 1916, p. 487. Compares statements of various authors regarding the value of oil flotation and shows that conclusions have not been uniform. Discusses and gives results of surface-tension tests by the authors.

BURCH, H. K. Concentration at Inspiration. Eng. and Min. Jour., vol. 102, Sept. 2, 1916, p. 411; Sept. 9, 1916, p. 457. Description of Inspiration concentrator.

CANADIAN MINING INSTITUTE. Pine oil for flotation purposes. Bull. 54, October, 1916, pp. 882–884. An account of experimental work by T. R. Jones at the Buffalo mine, Cobalt, in producing flotation oil by the destructive distillation of Norway pine.

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CANBY, R. C. Some notes on flotation. Eng. and Min. Jour., vol. 102, July 1, 1916. p. 29. Recounts early experiments with Teziutlan ores, in which Minerals Separation and the Elmores obtained identical results. Later Minerals Separation made tests of Inspiration ores, finding that the silicified schist ore floated well, whereas kaolinized granite would not float owing to intensive sliming. A mixture of the two ores floated well. Mentions other instances where change of physical and mechanical factors modified flotation results, and says that often some mechanical difference in the mill causes trouble that is laid to physical differences in the ore. Superficial tests of an ore may fail, whereas careful study may show that the ore can be easily treated.

CLARKE, J. H. The flotation decision of the Supreme Court. Min. American, vol. 73, Dec. 30, 1916, p. 30–31. Justice Clark discusses this case at length.

CLAUDET, H. H. Notes on molybdenite operations in Norway. Canadian Min. Inst., Bull. 51, July, 1916, pp. 609–616. A general discussion of molybdenite mining in Norway. States that the largest companies are concentrating the molybdenite by the Elmore vacuum process, the ore being crushed to 1 mm. (sometimes coarser) and separated in one operation, a small amount of oil and no acid being used.

CLAYTON, C. Y. Dielectric constants and flotation values of oils. Met. and Chem. Eng., vol. 15, Nov. 1, 1916. Gives results of some experiments carried on by Herman Schlundt, of the University of Missouri, C. Y. Clayton and C. E. Peterson, of the Missouri School of Mines and Metallurgy, Rolla, Mo., to see what relation, if any, exists between the dielectric constant and the flotation values of various oils.

——— Flotation bubbles. Met. and Chem. Eng., vol. 15, Sept. 15, 1916, p. 278. Shows and explains eight interesting photographs of flotation bubbles and bubble aggregates lifting particles of minerals.

CLEVENGER, G. H. A new source of flotation agents. Am. Inst. Min. Eng., Bull. 117, September, 1916, p. 1685. Discusses experimental work in flotation and the various products resulting from destructive distillation of sagebrush.

COGHILL, W. H. Molecular forces and flotation. Min. and Sci. Press, vol. 113, Sept. 2, 1916, pp. 341–349. Short illustrated article discussing and summarizing physical data of flotation.

COLE, A. A. The production of flotation oils in Canada. Canadian Min. Inst., Bull. 53, September, 1916, pp. 762–764. States that good flotation oils have been produced from red pine and spruce. The subject is being investigated by the Canadian Government under direction of the minister of the interior.

COLE, DAVID. The advent of flotation in the Clifton-Morenci district, Arizona. Am. Inst. Min. Eng. Bull. 117, September, 1916, p. 1611. Describes in detail experiments which led to present flotation practice in Clifton-Morenci district. Also copied in Min. and Sci. Press, vol. 113, Oct. 14, 1916, pp. 556–563.

COLLINS, G. E. Elmore and flotation. Min. and Sci. Press, vol. 113, Oct. 21, 1916, p. 588. A letter to the editor in which the writer considers that the claim of A. Stanley Elmore that his brother's first patent was the actual beginning of oil flotation is unwarranted.

DRUCKER, A. E. Cyaniding flotation concentrate. Min. and Sci. Press, vol. 113, Aug. 19, 1916, p. 264. Discusses briefly pumps and means for lifting flotation concentrates in cyanidation.

DURELL, C. T. Universal flotation theory. Mexican Min. Jour., vol. 21, 1916. p. 207; Colorado School of Mines Mag., vol. 6, February, 1916, pp. 27–34.

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ELMORE, A. S. Elmore and flotation. Min. and Sci. Press, vol. 113, Nov. 18, 1916, pp. 725–727. Reply to an editorial published in Min. and Sci. Press, Sept. 23, 1916.

——— The invention, development, and introduction of the flotation process. Min. and Sci. Press, vol. 113, Sept. 23, 1916, pp. 449–455. Short history of flotation by one of the inventors of the Elmore bulk oil process.

ENGINEERING AND MINING JOURNAL. Automatic oil and acid feeder. Vol. 102, Sept. 9, 1916, p. 468. Describes U. S. Patent 1,190,721, issued to Albert Campbell, July 11, 1916. The invention is devised to feed regularly a given quantity of acid or oil into the ore stream.

——— Cyaniding of flotation concentrates. Vol. 102, Sept. 23, 1916, p. 561. Discusses application of process in Mexican plants, also the question whether contained oils will be detrimental to cyaniding.

——— Differential flotation process. Vol. 102, July 29, 1916, p. 223. A recent British patent, No. 4,974, granted to Minerals Separation (Ltd.), comprises certain improvements in which ores are subjected to flotation separation with agitation in the presence of metallic copper or mercury, or of a compound of such metals, for obtaining preferential flotation and concentrates relatively rich in certain sulphides, such as zinc. An alkaline medium or a medium having a bichromate of an alkaline metal in solution is employed.

——— Eberenz & Brown concentrator-flotation. Vol. 102, Sept. 23, 1916, p. 549. Describes apparatus for concentration of ore by gaseous flotation of mineral particles in a liquid; U. S. Patent 1,187,822, June 20, 1916.

——— Facilitating flotation. Vol. 102, Sept. 16, 1916, p. 520. Briefly discusses a few flotation oils.

——— Flotation at Goldfield. Vol. 102, July 1, 1916, p. 19. The flotation equipment being installed will replace, at once or eventually, cyanide treatment. Twenty-eight Callow cells, having a capacity of 1,000 tons daily, will save annually about 360,000 tons, neglecting the higher extraction that will be made. Selective mining will also be avoided, especially in the lower levels which show much copper-bearing ore. Heretofore cyanide treatment was given only to ore containing less than 0.5 per cent copper.

——— Flotation case in Supreme Court: Vol. 102, Nov. 11, 1916, p. 861. On November 1 a flotation test was made in the room occupied by the Supreme Court of the United States. Names of the attorneys in the Hyde case are given.

——— A flotation mystery. Vol. 102, July 1, 1916, p. 47. Recounts an incident related by Prof. Richards at the May 12 meeting of the New York sections of the American Electrochemical Society and of the American Institute of Mining Engineers. The mill at Mascot, Tenn., was unable to float sphalerite successfully when first constructed. Investigation showed that the laboratory tests had been made in a bronze machine, while the mill machinery was made of iron and wood. On the theory that some copper might have dissolved, copper sulphate was introduced into the mill circuit, with excellent results. An explanation is sought.

——— Flotation oil disk feeder. Vol. 102, Nov. 11, 1916, p. 876. Describes feeder consisting of a rotating disk partly submerged in oil. An adjustable scraper removes any desired quantity of oil.

——— The flotation process decision. Vol. 102, Dec. 23, 1916, p. 1110. Brief comment on the decision.

——— Grondal flotation apparatus. Vol. 102, Dec. 2, 1916, p. 981. Brief description of U. S. Patent 1,202,512, Oct. 24, 1916.

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ENGINEERING AND MINING JOURNAL. Inspiration operations in August, 1916. Vol. 102, Oct. 7, 1916, p. 678. Gives mill statistics, including power required for flotation; also the consumption of oil.

——— Making durable flotation froth. Vol. 102, July 29, 1916, p. 223. States that the efficiency of flotation is believed to depend largely on quantity and durability of the froth, and that the process described is designed to accomplish an increase in both for a given quantity of common frothing agent, thus shortening the duration of the process and increasing extraction. The results are attained by adding to the oil employed the necessary percentage of a resinate of an alkali such as soda, potash, lime, or ammonia, the desired superior flotation oil consisting of petroleum 50 per cent, pine oil 15 per cent, resinate of soda or resinate of ammonia 35 per cent. Rosin oil may be substituted for rosin in the above mixture, and the proportions may be varied at will to suit different ores. This process is the invention of H. T. Yaryan, of Toledo, Ohio, granted U. S. patent 1,191,053, on July 11, 1916.

——— Miami copper data. Vol. 102, Oct. 14, 1916, p. 710. Gives flow sheet of mill and data on the oil used: 0.40 pounds oil used per ton; 50 per cent coal tar, 35 per cent creosote, 10 per cent pine oil, and 5 per cent cresol.

——— Minerals Separation decision. Vol. 102, Dec. 23, 1916, p. 1107. Briefly states the claims of Minerals Separation (Ltd.) that were upheld by the court.

——— Minerals Separation (Ltd.) *v.* James M. Hyde. Vol. 102, Dec. 16, 1916, p. 1068. Gives a review of the opinion of the court as taken from an unofficial copy of the decision. Suit decided in favor of Minerals Separation.

——— Minerals Separation (Ltd.) *v.* James M. Hyde. Vol. 102, Dec. 30, 1916, p. 1125. Contains corrections that should be inserted in the report of the U. S. Supreme Court in the Journal of December 16.

——— Minerals Separation (Ltd.), wins. Vol. 102, Dec. 16, 1916, p. 1071. Comments on Supreme Court decision, and emphasizes the fact that Mineral Separation (Ltd.) should use discretion in collecting what now becomes due it.

——— Minerals Separation North American Corporation. Vol. 102, Dec. 16, 1916, p. 1070. Notice that Minerals Separation (Ltd.) has been taken over by the corporation named.

——— Minerals Separation *v.* Miami. Vol. 102, Oct. 7, 1916, p. 683. Comments on Judge Bradford's decision, which considers as an infringement the use of a fraction of 1 per cent of oil. The use of 1.01 per cent of oil would accordingly be an infringement.

——— Minerals Separation *v.* Miami. Vol. 102, Oct. 21, 1916, p. 757. States that Miami Company must furnish a bond of $250,000, and must also make monthly reports of flotation operations to Minerals Separation (Ltd.).

——— Ohrn flotation concentrator. Vol. 102, July 29, 1916, p. 223. With the object of eliminating mechanical agitation provided in the earlier patented apparatus, a steam jet acting as an injector both introduces the ore into the separation cell and provides the necessary aeration and agitation. The inventor, G. E. Ohrn, of Stockholm, Sweden, was granted patent 1,187,772, June 20, 1916, which is assigned to Minerals Separation (Ltd.).

——— Silver and flotation. Vol. 102, July 1, 1916, p. 68. Comments on the influence of flotation on the metallurgy of silver, and the fact that much silver formerly lost in slimes can now be saved. Flotation like the cyanide process brings within range of economical beneficiation ores that formerly could not be profitably worked.

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ENGINEERING AND MINING JOURNAL. Sizing flotation concentrates. Vol. 102, Nov. 11, 1916, p. 867. Abstract of August, 1916, Bulletin, School of Mines and Metallurgy of University of Missouri, by C. Y. Clayton. Gives sizing tests of various flotation concentrates.

——— Tungsten-molybdenum ore concentration. Vol. 102, July 15, 1916, p. 126. Abstract of an article by A. J. Robertson in Bulletin 64 of the Geological Survey of Western Australia. The ore tested contained molybdenite, sheelite, and wolframite in a gangue of quartz, mica, and kaolin. The separation of the molybdenum by flotation was most successful when coarsely crushed ore (30-mesh) was dropped in a dry condition on the surface of water. This was followed by tabling the residue. It was possible to prepare concentrates containing 92.9 per cent MoS_2 and 57.2 per cent tungstic oxide, although the recoveries were low.

——— The use of flotation oils. Vol. 102, Nov. 4, 1916, p. 825. Refers to experiments on flotation oils made by C. Y. Clayton and C. E. Peterson, published in the August, 1916, bulletin of the School of Mines and Metallurgy of the University of Missouri.

——— Use of porous bottoms in flotation cells. Vol. 102, Oct. 28, 1916, p. 790. Refers to articles in Bulletin 117 of the American Institute of Mining Engineers, September, 1916. States that serviceable porous bottoms should be flexible. Canvas can be cleaned and kept in condition better than solid bottoms.

FLECK, HERMAN. The dressing of molybdenum ores. Min. American, vol. 73, Nov. 25, 1916, pp. 8–9. Excerpt from "A series of treatises on the rare metals." Proc. Colorado Sci. Soc., vol. 11.

GAHL, RUDOLF. History of flotation at Inspiration. Min. and Sci. Press, vol. 113, Sept. 23, 1916, pp. 460–462. Extracts from paper on development of flotation at Inspiration presented at the Tucson, Ariz., meeting of American Institute of Mining Engineers, September, 1916.

GAYFORD, ERNEST. Flotation at the Calaveras copper mine. Min. and Sci. Press, vol. 113, Dec. 16, 1916, p. 868. A short letter to the editor comparing the flotation mill at the Calaveras mine with that at the National mill in the Coeur d'Alene district, Idaho.

HANCOCK, R. T. The flotation process. Min. and Sci. Press, vol. 113, Aug. 5, 1916, p. 191. In a letter to the editor Mr. Hancock states that in West Africa he used a flotation process prior to all patents except that of Mrs. Everson.

HANDY, R. S. Bunker Hill and Sullivan milling data. Eng. and Min. Jour., vol. 102, July 1, 1916, p. 35. Contains data and detailed costs of the present mill at Kellogg, Idaho, with drawings of the Bunker Hill flotation machine. Pine oil is used in one half of the mill and eucalyptus oil in the other. Less eucalyptus oil than pine oil is needed and better work is done. The pulp ratio is kept constant at 3 to 1 by the use of a test bottle weighed on a Troemner bullion scale, with the beam graduated to read the dilution direct.

HILDEBRAND, J. H. Principles underlying flotation. Min. and Sci. Press, vol. 113, July 29, 1916, pp. 168–170. A clear and concise discussion of the rôle of surface tension in the flotation of minerals.

HUGHES, BEN. Concentrating cobalt silver ores by the oil flotation process. Canadian Min. Jour., Aug. 1, 1916, p. 365. Brief description of plants using the system in the Cobalt district, Ontario.

HYDE, J. M. An improved pneumatic flotation machine. Min. and Sci. Press, vol. 113, Aug. 5, 1916, pp. 199–201. Describes a new type of flotation machine so designed as to require a minimum of attention and embodying

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a number of novel features, such as individual air cells, means for preventing froth from flowing over tailings discharge, and a countercurrent of froth toward the feed end of the machine.

KEMPTON, GRISWOLD. Flotation efficiency problem. Eng. and Min. Jour., vol. 102, Nov. 25, 1916, p. 949. Asks where flotation could be introduced into flow sheet of a mill treating a complex ore containing lead, with nearly as much iron as zinc. Treatment is by magnetic and wet-gravity concentration, with extraction of 70 per cent of mineral value.

KRAUT, MAX. The Kraut-Kohlberg flotation machine. Min. and Sci. Press, vol. 113, July 1, 1916, p. 36. A detailed description, with drawings, of the Kraut-Kohlberg flotation machine by one of the inventors.

LAIST, FREDERICK, AND WIGGIN, A. E. Flotation concentration at Anaconda. Min. and Sci. Press, vol. 113, Dec. 9, 1916, pp. 847–848. A brief summary of a paper presented before the Arizona meeting of the American Institute of Mining Engineers, September, 1916. Gives notes on tests made in 1914, covering slime and 60-mesh tailings.

LAMB, M. R. Flotation for cinnabar. Min. and Sci. Press, vol. 113, July 1, 1916, p. 6. Discusses briefly the amenability of the quicksilver ores at Punitaqui, Chile, to flotation. Regards the process as favorable, but more expensive than the method of retorting in use.

LYON, D. A., AND RALSTON, O. C. The present status of the ore flotation process. Min. and Eng. World, vol. 45, Nov. 25, 1916, pp. 911–912. Reviews the present status of flotation and summarizes different types of ores that are being treated.

MCCARTY, MORRIS. Mount Baker mining district, Washington. Min. and Eng. World, vol. 45, Oct. 28, 1916, p. 745. States that the Hammon Co., situated some 15 miles south of the free-milling section of the district, has been reorganized and that George Crerar is installing the flotation process.

MEGRAW, H. A. Apparatus used in flotation. Eng. and Min. Jour., vol. 102, July 1, 1916, p. 5. A compilation from patent and current literature of descriptions of machines. Describes the Minerals Separation standard type and the Hebbard type; also the Callow, the MacQuisten, and the Wood machines and the Elmore vacuum apparatus. Mention is also made of the Murex magnetite process, but the more modern machines, such as the Janney, Cole-Bergman, Kraut, etc., are not discussed.

——— Use of oils in flotation. Eng. and Min. Jour., vol. 102, July 1, 1916, p. 50. A review of previous literature on flotation oils.

METALLURGICAL AND CHEMICAL ENGINEERING. Concentration and flotation of lead ores in southeast Missouri, vol. 15, July 15, 1916, p. 93. Six concentrating mills are operated by the Federal Lead Co., St. Louis Smelting & Refining Co., Desloge Consolidated Lead Co., and the St. Joseph Lead Co., which also controls the Doe Run Lead Co. In this article are discussed: (1) The general practice of flotation at the mills mentioned, (2) handling flotation concentrate, (3) flotation at the Bonne Terre mill, and (4) filtration of the flotation concentrate at this mill.

——— Flow sheet of Miami mill. Vol. 15, Nov. 1, 1916, p. 544. To supplement report of the Arizona meeting of the American Institute of Mining Engineers, published in previous issue of Met. and Chem. Eng., the flow sheet is given of the Miami mill, which was mentioned on p. 492.

——— Hyde flotation suit. Vol. 45, Nov. 15, 1916, pp. 555–556. Brief outline of hearing before Supreme Court in Washington.

——— The western metallurgical field. Vol. 15, Nov. 1, 1916, p. 507. At Georgetown, Colo., a testing plant is testing the dump of the Colorado Central, using a Dodge crusher, trommels, pocket feeders, a jig, Wilfley

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tables, Richards pulsator classifiers, Deister table for slimes, and a flotation machine. It is said the experiments are progressing satisfactorily and a mill will be in operation in the near future.

METALLURGICAL AND CHEMICAL ENGINEERING. The western metallurgical field. Vol. 15, Nov. 1, 1916, pp. 507–508. The Hill City Tungsten Production Co., at Hill City, S. Dak., started taking custom ores September 1, 1916. The outstanding features of the high efficiency obtained are close sizing, with duplicate screens below 16 mesh, to prevent stops for repairs; regrinding system, with duplicate pumps, etc.; treatment of tailings by flotation and canvas; and use of three coarse-crushing units, with intermediate screens to prevent sliming.

——— The western metallurgical field—Air flotation. Vol. 15, Dec. 1, 1916, p. 620. H. North is visiting the Joplin district with the view of introducing a new dry process of ore concentration, termed "air flotation," which is claimed to make a 2 per cent greater recovery than the wet concentration (jigs and tables) used in the district. A rock crusher and rolls are used to reduce the "dirt" to a fineness of 0.02 to three-eighth inch. A fan is used to separate the waste from the free ore, the latter falling into a special bin.

——— The western metallurgical field—Flotation. Vol. 15, Dec. 1, 1916, p. 620. Discusses devices used in several plants to regulate the flow of oil in the flotation process.

——— The western metallurgical field—Mills. Vol. 15, Oct. 1, 1916, pp. 372–373. The new flotation plant of the Big Four Exploration Co.'s mill, Park City, Utah, will be in operation in approximately a month's time.

——— The western metallurgical field—The Vindicator flotation test plant. Vol. 15, Oct. 1, 1916, pp. 372–373. Shows flow sheet of the Vindicator flotation test plant, and explains its new features.

MEXICAN MINING JOURNAL. Flotation work at University of Utah. Vol. 21, June, 1916, p. 201. A copy of an account published in the Salt Lake Tribune of the trip of officials of the Bureau of Mines to flotation mills.

MILLS, E. W. Leading gold-mining operations in Korea. Min. and Eng. World, vol. 45, Dec. 9, 1916. Excerpts from a paper read before the Korean branch of the Royal Asiatic Society. Gives some facts regarding gold mining in Korea and mentions two plants that are using the flotation process.

MINING AMERICAN. Flotation plants and the Supreme Court decision. Vol. 73, Dec. 30, 1916, p. 5. States that one of the next questions the Colorado Metal Mining Association should consider is the legal status of flotation patents, in the light of the Supreme Court decision, and the existing plants using the flotation system. Briefly discusses the subject.

——— Flotation testing in Denver. Vol. 73, Dec. 30, 1916, p. 15. Brief discussion; summarizes function of the flotation engineer.

——— Lead ore flotation. Vol. 73, Oct. 21, 1916, p. 4. In the last two years flotation has been widely applied to the concentration of lead ores in the United States. All the principal concentrating mills in the disseminated-lead district of Missouri have flotation units to handle slimes and fines. Flotation will be installed in the 2,500-ton mill of the Federal Lead Co. are being built. Flotation is extensively employed in treating lead and lead zinc ores of the Coeur d'Alene district in Idaho, also in many places in Colorado and some other Western States. It is estimated that the additional recovery of lead in 1915, due to the flotation process, was 50,000 tons of metal.

MINING AND ENGINEERING WORLD. American Institute of Mining Engineers discuss flotation processes. Vol. 45, Sept. 30, 1916, pp. 577–578.

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MINING AND ENGINEERING WORLD. Field's flotation machines in Arizona. Vol. 45, Nov. 18, 1916, p. 866. Describes flotation mill being built for Keystone Consolidated Mining Co., at Chloride, Ariz., the equipment to include Field flotation machines.

——— Flotation. Vol. 45, Aug. 12, 1916, p. 295. Reprint of a pamphlet on flotation oils, issued by the United Naval Stores Co. Contains considerable information on the use and properties of different oils now employed. States that wood-creosote oil is rapidly supplanting pine oil, which was formerly considered so favorably, because pine oil has increased in price and wood creosote gives nearly the same results. Discussion indicates that wood products will become more popular because of lesser cost.

——— Flotation patents decision is won by Minerals Separation (Ltd.). Vol. 45, Dec. 23, 1916, p. 1078. Minerals Separation North American Corporation, the newly organized company formed to handle the business of the Minerals Separation (Ltd.), with the United States Supreme Court's decision back of it, is expected to start injunction proceedings against various companies in the United States claimed to have been infringing its patents. Minerals Separation patents in the United States now number 45, and applications are pending for 32 more. These patents cover every conceivable feature of flotation and the uses of ingredients.

——— Large capacity flotation in small space. Vol. 45, Oct. 28, 1916, p. 746. Describes a concentrator of the flotation type suited for concentrating mills where little space is allowed for such machines, and where it is desirable to have as great efficiency per unit as possible.

——— Miami's flotation results. Vol. 45, Dec. 2, 1916, p. 950. Gives figures on the product handled by flotation by the Miami Copper Co., as shown in its first report, filed with the United States Circuit Court in connection with the Minerals Separation litigation.

——— Minerals Separation wins Supreme Court decision against Hyde. Vol. 45, Dec. 23, 1916, pp. 1065–1068. The official text of the decision is given in its entirety.

——— The Nevada-Utah property at Pioche, Nev. Vol. 45, Dec. 16, 1916, p. 1034. Description of the company's property and mill.

——— A new flotation machine. Vol. 45, Aug. 26, 1916, p. 365. A description of the new flotation machine of G. B. Eberenz and J. J. Brown, of Cripple Creek, Colo. In ore-concentrating apparatus of the type in which the ore is concentrated by gaseous flotation of mineral particles in a fluid, the impeller blades, which agitate the liquid, the finely ground ore, and the frothing agent, operate in a horizontal plane. Eberenz and Brown have devised blades that move in a vertical plane.

——— Oil-flotation process improved. Vol. 45, Sept. 30, 1916, p. 584. Frothing tendency of flotation oils can be increased by adding a certain percentage of resinate of an alkaline metal, such as soda, potash, or lime. Cites H. G. Yaryan's patent, wherein inventor states that in practice he was able to obtain a superior flotation oil by mixing 50 per cent petroleum, 15 per cent pine oil, and 35 per cent resinate of soda or resinate of ammonia.

——— Operations and methods in use at the Inspiration property, Arizona. Vol. 45, Nov. 11, 1916. Description of property and mill is given, with general map and flow sheet. Taken from folder especially prepared for visitors to the Arizona meeting of the American Institute of Mining Engineers, September, 1916.

——— Treating zinc-lead tailings at Midvale, Utah. Vol. 45, Sept. 2, 1916, p. 408. Describes method used for treating zinc-lead tailings from the plant of United States Smelting, Refining & Mining Co. Flotation machines used here are belt driven instead of gear driven.

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MINING AND SCIENTIFIC PRESS. Agreement between Minerals Separation and the Inspiration and Anaconda companies. Vol. 113, Sept. 16, 1916, pp. 424–425. A verbatim copy of contract between these two companies as included in the evidence in the Minerals Separation *v.* Miami suit at Wilmington, Del., in 1915.

——— Comments on work of the Elmore brothers in flotation. Vol. 113, Sept. 23, 1916, pp. 445–446.

——— Concentration at Miami. Vol. 113, Oct. 28, 1916, p. 639. Mill statistics, January to June, 1916.

——— Flotation. Vol. 113, Oct. 28, 1916, pp. 633–639. A report of the discussion on the subject of flotation before the American Institute of Mining Engineers at Globe, Ariz., Sept. 21, 1916.

——— Flotation and dividend payments. Vol. 113, Dec. 2, 1916, p. 813. An attempt on the part of Minerals Separation to prevent Butte & Superior from paying further dividends until its suit is decided.

——— Flotation in the Southwest. Vol. 113, Oct. 14, 1916, pp. 549–550. Editorial comment on recent papers on flotation.

——— Flotation in the Supreme Court. Vol. 113, Nov. 25, 1916, p. 778. A statement that the Minerals Separation *v.* Hyde case is before the United States Supreme Court, and a brief summary of the defendants' arguments.

——— Flotation oil from sagebrush. Vol. 113, Dec. 2, 1916, p. 806. A good flotation oil, comparable in all respects with pine oil, can be extracted from sagebrush at a moderate cost, approximately 60 cents a gallon.

——— Flotation royalties. Vol. 113, Sept. 16, 1916, pp. 406–407. Editorial comments on contracts between Minerals Separation and the Anaconda and the Inspiration companies.

——— Minerals Separation decision. Vol. 113, Dec. 23, 1916, p. 919. A brief summary of the decision, with comments thereon.

——— Minerals Separation wins. Vol. 113, Dec. 16, 1916, p. 866. Comments on the Supreme Court's decision in the case of Minerals Separation *v.* J. M. Hyde.

——— The Murex flotation process. Vol. 113, Aug. 5, 1916, p. 204. A brief description of the flotation process invented by A. A. Lockwood, in which various blends of crude oil, 15 to 20 pounds per ton of ore, are used with an equal amount of 100-mesh magnetite. The mixture of oil and ore is fed into a slowly revolving horizontal tube which contains several hundred pounds of rough iron shot. The oil-magnetite mixture collects the concentrate which flows with the pulp into a shaking tray at the discharge end of the tube, where it is removed by a powerful electromagnet.

——— A new flotation oil. Vol. 113, Sept. 23, 1916, p. 467. Brief account of experiments at the University of Nevada with oil from sagebrush. The common sagebrush, *Artemesia tridentata*, gives by destructive distillation an excellent flotation oil.

——— Text of Minerals Separation *v.* Hyde decision. Vol. 113, Dec. 30, 1916, pp. 943–946. The complete text of the decision.

——— Treatment of molybdenite. Vol. 113, Nov. 4, 1916, p. 667. A brief description of a simple flotation plant for treating molybdenite at Renfrew, Ontario.

——— The Wilmington decision. Vol. 113, Oct. 7, 1916, pp. 516–517. A statement of the decision of the United States district court in the case of Minerals Separation against the Miami Copper Co., with editorial comments.

——— The Wilmington decision. Vol. 113, Oct. 28, 1916, pp. 619–620. A discussion of the decision in the case of Minerals Separation against the Miami Copper Co.

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MINING AND SCIENTIFIC PRESS. The Wilmington decision on flotation. Vol. 113, Oct. 14, 1916, pp. 531–555. Oct. 21, 1916, pp. 591–596. First and second parts of the complete text of the opinion of Judge Bradford in the United States district court, Minerals Separation against the Miami Copper Co.

MOTHERWELL, WILLIAM. Chronology of flotation. Eng. and Min. Jour., vol. 102, Dec. 9, 1916. Gives name, location, daily tonnage, metals in ore, and process used for flotation plants throughout the world up to the end of 1914.

MUELLER, W. A. Froths formed by flotation oils. Eng. and Min. Jour., vol. 102, July 1, 1916, p. 31. An excellent paper discussing the characteristics of the flotation froths formed by the use of pine oil, coal tar, coal creosote, wood creosote, cresylic acid, turpentine, fuel oil, pine-tar oil, oleic acid, and eucalyptus oil. The effect of overoiling and of the entrance of lubricating oil into the system is discussed. Photographs of the froths are reproduced.

NELSON, L. G. Flotation on silver ore. Min. and Sci. Press, vol. 113, Aug. 12, 1916, pp. 229–230. A short description of a flotation plant using Minerals Separation and Callow machines at the Monitor-Belmont mine, at Belmont, Nye County, Nev.

PALMER, R. C., ALLEN, G. L., AND RALSON, O. C. Some miscellaneous wood oils for flotation. Am. Inst. Min. Eng., Bull. 116, August, 1916, p. 1387. Discusses the cooperative work that has been undertaken by the forests products laboratory of the Department of Agriculture, the metallurgical research department of the University of Utah, and the United States Bureau of Mines for the purpose of obtaining reliable data regarding the value as flotation agents of a number of products that are obtained from the distillation of wood by different methods and incidentally to determine whether some of the products not used at present can be utilized for that purpose.

PARMELEE, H. C. Recent developments in zinc concentration practice in the Joplin district, Missouri. Met. and Chem. Eng., vol. 15, Sept. 15, 1916, p. 320. Discusses possibilities of flotation in Joplin district.

PEARCE, J. A. Flotation tribulations. Min. and Sci. Press, vol. 113, Sept. 16, 1916, pp. 427–430. Discusses attempt to install flotation in the Argo mill in Colorado, its failure at first, followed by success.

PENHOEL, L. C. Notes on flotation in the Southwest. Min. and Eng. World, vol. 45, Oct. 7, 1916, pp. 623–624. The following subjects are briefly discussed: Efficiency being studied—mixture used; dewatering of concentrates; storage—bin designs; use of oils and reagents; feeding; types of machines introduced.

PILGRIM, E. R. Flotation tests on an antimony gold ore. Eng. and Min. Jour., vol. 102, Nov. 4, 1916, p. 820. Gives the results of tests on an ore carrying 18 to 40 per cent antimony and 0.1 to 0.2 ounce gold per ton. Antimony so finely mixed with quartz that ore can not be concentrated.

PRINGLE, S. B. Chart for flotation testing. Eng. and Min. Jour., vol. 102, Oct. 21, 1916. Gives chart and formula for calculating charge for a flotation testing machine, necessary for a constant feed of 1,150 c. c. volume and a density of 1.2.

RAIN, A. D. The separation of galena from blende by the Horwood process of flotation: Min. and Sci. Press, vol. 113, Oct. 7, 1916, pp. 529–530. An abstract of an article by the same author in Teniente Topics, published by the Braden Copper Co., Chile, which describes the Horwood process in considerable detail. The finely crushed ore is given a light roast, which sulphatizes the galena but does not affect the sphalerite; then the two minerals are separated by flotation.

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RALSTON, O. C., and ALLEN, G. L. The flotation of oxidized ores. United States Bureau of Mines circular. Also Met. and Chem. Eng., vol. 15, Aug. 1, 1916, p. 153. Preliminary report of the experiments on the flotation of oxidized ores by the Bureau of Mines and the University of Utah.

RICKARD, T. A. The Britannia mine and mill. Min. and Sci. Press, vol. 113, Nov. 11, 1916, pp. 693–700. A detailed description of the mine and mill, with illustrations and flow sheet of the mill, which uses gravity concentration combined with flotation.

ROBBINS, HALLET R. Flotation at the Calaveras Copper—A simple flow sheet. Min. and Sci. Press, vol. 113, Nov. 25, 1916, pp. 769–773. A description, with illustrations and flow sheet, of a successful flotation plant at the Union mine, Copperopolis, Cal. The ore is pyrite and chalcopyrite in amphibolite schist and is treated by selective crushing followed by preferential flotation.

SALT LAKE MINING REVIEW. Research work at the University of Utah, vol. 18, Nov. 30, 1916, pp. 26–27. States that the research work in flotation and other ore treatment processes that has been carried on at the University of Utah in cooperation with the Bureau of Mines, during the past several years, is among the most important done in this country, processes having been worked out that will add millions of dollars to the wealth of the world.

SCHWARZ, A. Interesting points in the United States district court flotation decision. Met. and Chem. Eng., vol. 15, Nov. 15, 1916, pp. 554–555. An interesting discussion of the subject.

SCOTT, W. A. Mining and milling at Robinson, Colo. Min. and Eng. World, vol. 45, Nov. 18, 1916, pp. 865–866. Describes the Progress Mining & Milling Co. mine and mill, situated at Robinson, Colo. Ore is crushed by Symons No. 5 and No. 3 crushers and ground by 42-inch by 18-inch Traylor rolls to 16 mesh, and passed to 10 Butchart roughing tables, making a coarse lead concentrate. The table tailings are discarded, and the middlings ground finer than 50-mesh in two 6-foot by 6-foot ball mills. This product is classified, and the thickened material is treated by 12 Wilfley tables, making clean lead and iron products; also a zinc-iron middling which is reconcentrated on other Wilfley tables, making a clean zinc product. The iron-zinc middling from the last process is passed to three Traylor flotation machines, belt driven. These machines are turning out a flotation product running 45 per cent zinc.

——— Mining operations in Bingham Camp, Utah. Min. and Eng. World, vol. 45, Sept. 16, 1916, p. 492. States that Utah Metal & Tunnel Co. is building a flotation plant in a separate building to treat slimes from the gravity concentrating mill. The plan is to pass slimes through Dorr classifiers and thickeners; then to Pachuca mixers, where oils will be introduced; and then to flotation machines, which consist of Callow cells, four roughers, and one cleaner.

——— Notes on Daly-West mill, Park City, Utah. Min. and Eng. World, vol. 45, Sept., 1916, p. 411. Gives comprehensive data on process used for treatment of ores.

——— The Roosevelt Tunnel and Cripple Creek mine operations. Min. and Eng. World, vol. 45, Oct. 7, 1916, pp. 613–617. On taking over the Golden Cycle the Vindicator Co. proceeded to build thereon and equip with two 6-cell Minerals Separation machines, a 350-ton daily capacity flotation plant.

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SCOTT, W. A. Sulphidizing carbonate tailings for treatment by oil. Min and Eng. World, vol. 45, Dec. 2, 1916, p. 946. Describes process used in the mill of the Prince Cons. Mining & Smelting Co., at the old site of Bullionville, 2 miles west of Panaca, Nev.

SHELLSHEAR, W. Flotation of gold and copper ores at Mount Morgan mine, Queensland. Min. and Eng. World, vol. 45, Dec. 2, 1916, pp. 947–948. Excerpt from paper read before Australian Institute of Mining Engineers. Covers following subjects: Notes on oils used; comparative laboratory test of eucalyptus and eucalyptus-residuum mixtures; method adopted in large-scale concentration plant; smelting ore.

——— Flotation at Mount Morgan. Eng. and Min. Jour., vol. 102, Oct. 21, 1916, p. 755. Excerpt from an article in Proceedings of Australian Institute of Mining Engineers, June, 1916, describing the results of flotation test of Mount Morgan ore.

SMITH, H. H. The theory of flotation. Min. and Sci. Press, vol. 113, July 1, 1916, pp. 16–18. Suggests that the problem of elucidating the theory of flotation may be greatly simplified if the various physical forces involved be studied separately and in detail, as follows: (1) The forces governing the formation of bubbles in a pulp; (2) the forces governing the attachment of bubbles to sulphide particles in a pulp; (3) the forces governing the stability of the bubble attachment; (4) the forces governing the stability of a bubble at the free surface of a pulp.

SMITH, R. W. Flotation of flour gold. Eng. and Min. Jour., vol. 102, July 1, 1916, p. 25. Describes the improvement afforded by flotation in an unnamed mill treating an ore containing gold, silver, lead, zinc, and copper with some iron, all as sulphides in a rather heavy gangue. Much of the gold happened to be flour gold, and after the introduction of flotation the recoveries of flour gold were higher. Tabling the flotation product showed a strand of this material with the lead concentrate. The flow sheet was simplified and the extractions of all metals were improved by the introduction of flotation.

SNYDER, B. M. Launder flotation machine. Eng. and Min. Jour., vol. 102, Dec. 16, 1916, p. 1060. Describes a pneumatic flotation machine, in which the pulp flows through short launders. A porous bottom, through which air is admitted, is made of 4-ply 14 or 16 ounce canvas.

STANDER, H. J. Advancements and present status of preferential flotation. Min. and Eng. World, vol. 45, Nov. 18, 1916, pp. 861–864. Reviews the subject from the standpoint of the practical operator.

——— Alaska has one up-to-date flotation plant, the Kennecott. Min. and Eng. World, vol. 45, Nov. 11, 1916, pp. 821–822. Brief discussion of flotation in Alaska; also its possibilities for the future. States that the copper ore coming to the Kennecott plant for treatment averages 2.3 per cent copper, concentrates assay 18 per cent copper, and tailings contain 0.3 per cent copper.

——— Flotation. Min. and Eng. World, vol. 45, Nov. 25, 1916, pp. 910–911. A paper read before the American Institute of Mining Engineers, dealing in general terms with both theory and practice. A theory that gangue mineral ore is more "porous" than sulphides is advanced.

——— The function of oil and acid in flotation. Min. and Eng. World, vol. 45, Aug. 19, 1916, p. 317.

TAGGART, A. F., and BEACH, F. E. An explanation of the flotation process. Am. Inst. Min. Eng., Bull. 116, August, 1916, p. 1373. A clear discussion of the subject. Also Met. and Chem. Eng., vol. 15, Nov. 1, 1916, p. 518.

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TERRY, JOSEPH T., Jr. Flotation concentrates of carbonate ores. Min. and Sci. Press, vol. 113, Oct. 7, 1916, p. 531. Discusses briefly the methods of sulphidizing carbonate ores of copper and lead in order that they may be concentrated by flotation.

WARTENWEILER, F. Flotation concentration experiments on a Transvaal gold ore. Trans. Chem. Met. and Min. Soc. South Africa, vol. 17, November, 1916, pp. 87–90. The ore tested was an arsenical pyrite from the Barberton mine below the oxidized zone. Cyaniding the raw ore gave a maximum extraction of 45 per cent. Roasting followed by cyanidation gave a net extraction of 82.5 per cent. Flotation followed by cyanidation of the flotation tailing and roasting and cyanidation of the flotation concentrate gave a total extraction of 87.1 per cent and a more simple flow sheet. Wood creosote combined with various petroleum products was the best flotation oil.

WHITAKER, W. A., BELCHIC, GEORGE, and VAN VELZER, H. L. Flotation experiments on a Joplin tailing. Met. and Chem. Eng., vol. 15, Aug. 1, 1916, p. 131. Describes an investigation carried on by the University of Kansas, to aid the possible application of flotation in the Joplin district by determining the behavior of oils, or mediums, when used on a particular tailing, thereby indicating those that give the richest concentrates and the highest extractions.

WITTICH, L. L. Flotation in Joplin district. Eng. and Min. Jour., vol. 102, July 1, 1916, p. 45. Of all the flotation experimental plants in the district, the only one reported doing successful work is that of the Mining & Flotation Co., of Denver, which has a lease on the Granby Mining & Smelting Co. property in Leadville Hollow, near Joplin, Mo. Pine oil is the chief ingredient of the oil mixture. Eighty tons is treated daily, part of it by tables and the slimes by flotation. The material treated is old tailing, enough being on hand to supply the mill several years. It contains only about 1 per cent of blende.

UNITED STATES PATENTS RELATING TO FLOTATION.

BACON, R. F. Concentration of ores. U. S. Patent 1,197,590, Sept. 12, 1916. The method of separating metal constituents forming acid-soluble and acid-insoluble sulphides from each other and from associated gangue by dissolving the soluble constituents with an acid, precipitating with hydrogen sulphide in the presence of an excess of acid and subjecting the resultant mixture to a flotation treatment.

——— Process for treating ores. U. S. Patent 1,197,589, Sept. 12, 1916. Separation of nonsulphide minerals from associated gangue by subjecting them to action of hydrogen sulphide in presence of sulphur dioxide, whereby colloidal sulphur is formed and minerals are converted into sulphides, and ore recovered by flotation.

BRADFORD, LESLIE. Separation of metallic sulphides. U. S. Patent 1,182,890, May 16, 1916. A process for the preferential or selective separation of zinc sulphides from lead sulphides in ores containing mixed sulphides; the ores are agitated with a frothing agent in a heated, feebly acidulated solution of common salt.

CALLOW, J. M. Apparatus for concentrating ores. U. S. Patent 1,201,934, Oct. 17, 1916. A Callow cell provided at the end with a valve-controlled bottom discharge for coarse sands, and a pipe connection running from near the discharge opening to the head of a second cell. The velocity of flow through the pipe can be regulated to maintain a classifying current therein.

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CAMPBELL, ALBERT. Oil and acid feeder. U. S. Patent 1,190,721, July 11, 1916. Invention is apparatus to feed the frothing agent to the pulp in measured quantities. The object of the machine is that feed shall be constant and uniform irrespective of frothing agent in container or tank from which it is fed to ore stream. The feeder provided is said to be simple and light in construction and easy to operate.

EBERENZ, G. B., and BROWN, J. I. Ore concentrator. U. S. Patent 1,187,822, June 20, 1916. Describes apparatus for concentration of ore by gaseous flotation of mineral particles in liquid.

FAGERGREN, WILLIAM, and GREEN, W. D. Ore concentrator. U. S. Patent 1,195,453, Aug. 22, 1916. An agitating tank provided with baffles and a rotating impeller into which air is admitted as desired. Ore pulp is fed into the tank near the bottom.

GRONDAL, GUSTAF. Method of concentrating ores by flotation. U. S. Patent 1,202,512, Oct. 24, 1916. Oil is distributed in a stream of heated gas under pressure, thereby atomizing the oil; this gas-oil flow is then mingled with a larger quantity of another gas, and the mixture is forced through a counterflow of pulp.

HOWARD, A. C. Concentration of ores. U. S. Patent 1,203,341, Oct. 31, 1916. A flotation process which consists in adding to an ore pulp a small proportion of an alkali, such as caustic soda in concentrated form, agitating, aerating, and separating the froth that is formed.

JANNEY, T. A. Ore-concentrating apparatus. U. S. Patent 1,201,053, Oct. 10, 1916. A single-spitzkasten form of flotation machine, with a vertical-shaft mechanical agitator, having an individual driving motor connected to the top of the shaft.

LAVERS, HENRY, GREENWAY, H. H., and LAWRY, A. H. P., assignors to Minerals Separation American Syndicate (Ltd.). Concentration of ores. U. S. Patent 1,208,334, Dec. 12, 1916. Process consists in agitating and aerating an ore pulp heated or unheated containing an alkaline substance or a salt of a mineral acid having an alkaline reaction, but without the use of oil or other frothing agent beside said alkaline substance or salt, so as to obtain a froth, and separating the froth.

——— Concentration of sulphide ores. U. S. Patent 1,208,171. Process consists in agitating and aerating the pulp containing an alkaline modifying agent or a carbonate of an alkaline metal, either with or without the addition of a frothing agent, and obtaining a froth containing all the floatable minerals, the solution being alkaline during the process.

LYSTER, F. J. Concentration of ores. U. S. Patent 1,203,373, Oct. 31, 1916. Flotation concentration of ores by agitating and aerating an ore pulp containing in solution an alkaline selectivity modifying agent and a small proportion of frothing agent, so as to obtain a froth in an alkaline solution.

——— Concentration of ores. U. S. Patent 1,203,374, Oct. 31, 1916. Flotation concentration of ores by agitating and aerating an ore pulp containing in solution a metal chloride (such as sodium chloride) in sufficient quantity to greatly facilitate the formation of a froth, and then separating the froth.

——— Concentration of ores. U. S. Patent 1,203,375, Oct. 31, 1916. Flotation concentration of ores by agitating and aerating an ore pulp with an abnormal amount of an alkaline hydrate (as calcium hydrate) so as to act as a selectivity modifying agent, forming a froth, and separating.

——— Separation of metallic sulphide ores. U. S. Patent 1,203,372, Oct. 31, 1916. A process for separating lead sulphide from zinc sulphide by agi-

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tating ores containing these sulphides with a frothing agent in a nonacid solution of the mineral acid salts of metals which form basic hydroxides and thereby separating the lead sulphide from the zinc sulphide.

MISHLER, RALPH T. Apparatus for separating oiled concentrates from the gangue of ores. United States Patent 1,197,843, September 12, 1916. A machine using both compressed air and mechanical agitation. A series of agitating blades is mounted on a horizontal shaft.

THOMPSON, A. W., and COLE, DAVID. Process and apparatus for separation of ores by flotation. United States Patent 1,180,089. A method of breaking down flotation froth; the stream of froth is run under a nozzle from which issues a whirling jet of air into which water is introduced axially, so that it impinges on the froth in globular form.

YARYAN, H. T. Process of concentrating metallic ores by flotation. United States Patent 1,191,053, July 11, 1916. Process consists of agitating the ores in comminuted form in water to which is added a mixture consisting of 65 per cent oil and 35 per cent resinate of soda, petroleum constituting more than 50 per cent of the whole, and then by flotation recovering the concentrate.

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PLANTS IN THE UNITED STATES AND CANADA USING FLOTATION.

The following list of companies and mines in the United States and Canada using the flotation process has been compiled from statements published in the technical press up to January 1, 1917. Being based on these statements the list may not be complete and the Bureau of Mines assumes no responsibility for its correctness. However, it is presented as indicating the extent to which the flotation process is being used for treating ores.

Plants in the United States and Canada using the flotation process.

Name of company or mine.	County.	Town.
ALASKA.		
Kennecott Copper Corporation		Latouche.
ARIZONA.		
American Molybdenum mine		Cedar Valley.
Arizona Copper Co	Greenlee	Morenci.
Arizona Empire mines	Yuma	Parker.
Arizona mine	Yavapai	Chaparal.
Butte Mining & Smelting Co		Stockton Hill.
Consolidated Arizona Smelting Co	Yavapai	Humbolt.
Copper Queen Consolidated Mining Co	Cochise	Bisbee.
Detroit Copper Co	Greenlee	Morenci.
Dunkirk & Poverty mine	Yavapai	Prescott.
Duquesne Mining & Reduction Co	Santa Cruz	Duquesne.
First Home Co., Big Bug district (?)	Yavapai	Prescott.
Inspiration Consolidated Copper Co	Gila	Miami.
Keystone Consolidated Mining Co	Mohave	Chloride.
Leviathan copper mine		Cedar Valley.
Lincoln mine	Yavapai	Prescott.
Magma Copper Co	Pinal	Superior.
Miami Copper Co	Gila	Miami.
Montezuma mine	Yavapai	Prescott.
Old Dominion Copper Mining & Smelting Co	Gila	Globe.
Pasquale Copper Co	do	Bellevue.
Randolph-Gemmill Development Co	Yavapai	Crown King.
Ray Consolidated Copper Co	Pinal	Ray.
Ray Hercules Copper Co	do	Do.
R. R. R. mine	Santa Cruz	Patagonia.
Schuylkill mines	Mohave	Chloride.
Shannon Copper Co	Greenlee	Clifton.
Shattuch-Arizona Copper Co	Cochise	Bisbee.
Silver King Mining Co	Pinal	Superior.
Stoddard Mines Co	Yavapai	Stoddard.
Supersition Mining Co		Hewitt.
Union Basin Mining Co	Mohave	Golconda.
Western Gold & Copper Co	Yavapai	Huron.
Western Ore Concentrating Co. (Blackfoot group)	Mohave	Chloride.
CALIFORNIA.		
Calaveras Copper Co	Calaveras	Copperopolis.
Darwin Development Co	Inyo	Darwin.
Dutch-App group	Tuolumne	Jamestown.
Engels Copper Co	Plumas	Taylorsville.
Encinitas Copper Co	San Diego	Encinitas.
Forbestown Consolidated Co	Butte	Forbestown.
Lucky Jim mine	Inyo	Darwin.
McKeen mine	Siskiyou	Callahan.
Major Mining Co	do	Walker.
Mountain Copper Co	Shasta	Keswick.
Needles Mining & Smelting Co	San Bernardino	Needles.
Penn Mining Co		
Southern Cross mill (Towle)	Butte	Forbestown.
Walker Copper Co	Plumas	Portola.
Weringer Mines Co	Kern	Woody.

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Plants in the United States and Canada using the flotation process—Continued.

Name of company or mine.	County.	Town.
COLORADO.		
Argo Reduction & Ore Purchasing Co.	Clear Creek	Idaho Springs.
Atlas Mining & Milling Co.	Ouray	Sneffles.
Black Cloud mill.	Boulder	Salina.
Bon Ton Mining & Leasing Co.	Gunnison	Pitkin.
Colorado Central mine (Colorado Metal Milling Reduction Co.)	Clear Creek	Georgetown.
Colorado Utah Mines Co.	Hinsdale	Lake City.
Contention mill (Little Giant Mining & Milling Co.)	Clear Creek	Lawson.
Denver Mining & Milling Co.		Worthman.
Gem mill.	Clear Creek	Idaho Springs.
Gillard Tungsten Mining & Leasing Co.	Teller	Cripple Creek.
Gold Crown Mining & Reduction Co. (Foerster mill)	Ouray	Ouray.
Gold Hill Concentrating Co.	Boulder	Boulder.
Gold King Leasing Co.		Gladstone.
Green Mountain Co.	San Juan	Silverton.
Hamlet Mining & Milling Co.		Middleton.
Humphrey's mill.	Mineral	Creede.
Iowa mill (Silver Ledge).	San Juan	Silverton.
Kittimac mill.	do.	Eureka.
Mary Murphy mine.	Chaffee	Romley.
Mears-Willfley mill (American Ore Flotation Co.)	San Juan	Silverton.
Montezuma Mines & Milling Co.	Summit	Montezuma.
Mountain Top mine.	Ouray	Ouray.
Newton mill.	Clear Creek	Idaho Springs.
North Star Mining & Milling Co.	San Juan	Silverton.
Oneida-Stag Mines & Mills Co.	Clear Creek	Idaho Springs.
Paramount Reduction Co.	Chaffee	St. Elmo.
Philadelphia Mines Co.	Summit	Montezuma.
Pingree Mining & Milling Co.	Lake	Leadville.
Portland Gold Mining Co.	Teller	Victor.
Progress Mining & Milling Co.		Robison.
Puzzle Leasing Co.	Summit	Breckenridge.
Silver Ledge mill.	San Juan	Silverton.
Silver Stag mill.		Freeland.
Smuggler Union Co.	San Miguel	Telluride.
St. John mines (Ltd.)	Summit	Montezuma.
Sunnyside mill.	San Juan	Eureka.
Universal Mining & Milling Co.		Crystal.
Valley View mine (?)	La Plata	La Plata.
Victoria Consolidated	Teller	Cripple Creek.
Vindicator Consolidated Gold Mining Co.	do.	Victor.
IDAHO.		
Boise Rochester Mining Co.	Ada	Boise.
Bunker Hill & Sullivan Mining & Concentrating Co.	Shoshone	Kellogg.
Caledonia Mining Co.	do.	Do.
Coeur d'Alene Antimony Co.		Pine Creek.
Consolidated Interstate-Callahan Mining Co.	Shoshone	Wallace.
Douglas mine (Anaconda Copper Co.)		Pine Creek.
Empire Copper Co.	Shoshone	Enaville.
Federal Mining & Smelting Co.	do.	Burke.
Do.	Blaine	Hailey.
Do.	Shoshone	Kellogg.
Do.	do.	Mullan.
Do.	do.	Wallace.
Gold Hunter Mining & Smelting Co.	do.	Mullan.
Hecla Mining Co.	do.	Gem.
Hercules Mining Co.	do.	Wallace.
Highland Surprise Consolidated Mining Co.		Pine Creek.
Idora mill.	Shoshone	Wallace.
Independent Development Co.	do.	Do.
Lost Packer Mining Co.	Custer	Bonanza.
Marsh Mining Co.	Shoshone	Wallace.
National Copper Co. (Hecla)	do.	Mullan.
Ontario Mining Co.	do.	Kellogg.
Ray Jefferson Mining Co.	do.	Wallace.
Silverado Mining Co.	do.	Osborn.
Standard Mining & Milling Co.	do.	Do.
Stuart Mining Co.	do.	Kellogg.
Success Mining Co.	do.	Wallace.
Tamarack & Chesapeak	do.	Do.
KANSAS.		
Empire mine.	Cherokee	Galena.
KENTUCKY.		
Tennessee Zinc Co.	Crittenden	Marion.
MICHIGAN.		
Calumet & Hecla Mining Co.	Houghton	Calumet.
Copper Range Consolidated Co.	do.	Houghton.
White Pine Copper Co.	Ontanagon	Ontanagon.
White Pine Extension Mining Co.	do.	Do.

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Plants in the United States and Canada using the flotation process—Continued.

Name of company or mine.	County.	Town.
MISSOURI.		
American Zinc Lead & Smelting Co. (Vogey mine)	Jasper	Carterville.
American Zinc Lead & Smelting Co. (Granby mines)	Newton	Granby.
Desloge Lead Co	St. Francois	Desloge.
Federal Lead Co. (2 mills)	do	Flat River.
Mineral Recovery Co	Jasper	Joplin.
Mining & Flotation Co. (Leadville Hollow)	do	Do.
National Lead Co. (St. Louis Smelting Co.)	St. Francois	St. Francois.
Oronogo Circle Mining Co	Jasper	Oronogo.
St. Joseph Lead Co	St. Francois	Bonne Terre.
Do	do	Leadwood.
Do	do	Rivermines.
MONTANA.		
Anaconda Copper Co	Deerlodge	Anaconda.
Atwater mill	Jefferson	Basin.
Boston & Corbin Mining Co	do	Corbin.
Brooklyn Mining Co	Granite	Maxville.
Butte & Superior Mining Co	Silverbow	Butte.
Butte Detroit Copper & Zinc Milling Co	do	Do.
Comet Mining Co	Jefferson	Basin.
East Butte Copper Mining Co	Silverbow	Butte.
Federal Mining & Smelting Co	Mineral	Iron Mountain.
Royal Basin Mining Co	Granite	Maxville.
Snowstorm Mines Consolidated Co	Lincoln	Troy.
Timber Butte Mining & Milling Co	Silverbow	Butte.
NEVADA.		
Amalgamated Pioche Co. (Consolidated Nevada-Utah)	Lincoln	Pioche.
Battle Mountain Mines & Development Co	Lander	Battle Mountain
Belmont Big Four Mining Co. (2 plants)	Nye	Belmont.
Consolidated Copper Mines Co	White Pine	Kimberley.
Florence Goldfield Mining Co	Esmeralda	Goldfield.
Goldfield Consolidated Mining Co	do	Do.
Gold Great Bend Mining Co	do	Do.
Monitor Belmont Mining Co	Nye	Belmont.
Nevada Consolidated Copper Co	White Pine	McGill.
Prince Consolidated Mining Co	Lincoln	Pioche.
NEW MEXICO.		
Burro Mountain Copper Co	Grant	Tyrone.
Chino Copper Co	do	Hurley.
Cleveland mine (Empire Zinc Co.)	do	Silver City.
Eighty Five Mining Co	do	Lordsburg.
El Paso Mining Co	do	Pinos Altos.
Krull & Rumball	do	Do.
Memphis Red River Mining Co. (Taos Co.)	Taos	Red River.
Ozark mill (Sherwin Williams Paint Co.)	Socorro	Magdalena.
OKLAHOMA.		
Picher Lead Co		Picher.
OREGON.		
Ben Harrison mine	Baker	Whitney.
Copper King Mining Co		Grove Creek.
Homestead Iron Dyke Mines Co	Baker	Homestead.
SOUTH DAKOTA.		
Hill City Tungsten Production Co	Pennington	Hill City.
TENNESSEE.		
American Zinc, Lead & Smelting Co	Knox	Mascot.
Tennessee Copper Co	Polk	Ducktown.
UTAH.		
Big Four Exploration Co	Summit	Park City.
Bingham New Haven Mining Co		Bingham.
Broadwater mill	Summit	Park City.
Caldo Mining Co	Beaver	Frisco.
Daly West Mining Co	Summit	Park City
Judge Mining & Smelting Co	do	Do.
Midvale Minerals Co	Salt Lake	Midvale.
Ohio Copper Co	do	Lark.
Silver King Coalition Mines Co	Summit	Park City.
Silver King Consolidated Mining Co	do	Do.
Utah Apex Mining Co		Bingham.
Utah Metal & Tunnel Co		Do.
Utah Copper Co. (2 plants)	Salt Lake	Garfield.
Utah Leasing Co	Beaver	Newhouse.

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Plants in the United States and Canada using the flotation process—Continued.

Name of company or mine.	County.	Town.
VIRGINIA.		
Bertha Mineral Co	Wythe	Austinville.
WASHINGTON.		
Intermountain Mining Co. (mine in Montana)	Spokane	Spokane.
Lead & Zinc Mining Co	Pend Oreille	Metaline.
United Copper Co	Stevens	Chewelah.
WISCONSIN.		
Vinegar Hill Mining Co	Lafayette	Benton.
CANADA.		
Britannia Mining & Smelting Co	B. C	Britannia Beach.
Buffalo Mines (Ltd.)	Ont	Cobalt.
Coniagas Mines (Ltd.)	do	Do.
Dominion Reduction Co	do	Do.
Hydro-Electric Smelting Co	Newfoundland	St. Johns
King Edward mill	Ont	Cobalt.
McKinley-Darragh-Savage Mines Co	do	Do.
Metals Recovery Co	do	Do.
Molybdenum Mining & Milling Co	B. C	Alice Arm
Mond Nickel Co	Ont	Coniston.
Nipissing Mining Co	do	Cobalt.
Northern Customs Concentrators (Ltd.)	do	Do.
Sable River Mining Co	do	Massey.
Silverton Mines (Ltd.)	B. C	Silverton.
Standard Silver Lead Co	do	Do.
Slocan Star Mining Co	do	Sandon.
Tretheway mine	Ont	Cobalt.

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